Installation & Maintenance Data

IM 498-1

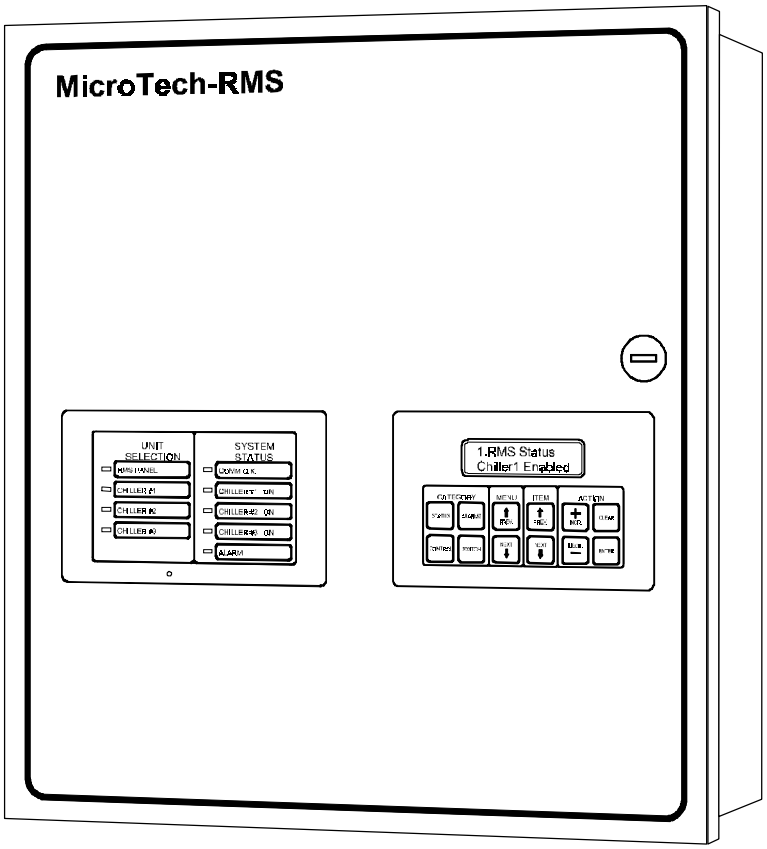
Group: **Controls**

Part Number: **571560Y-01**

Date: **January 1998**

MicroTech®
Remote Monitoring and Sequencing Panel

Reciprocating (ALR & WHR) and Air-Cooled Screw (ALS) Chillers



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Contents

Contents 2
Illustrations 2
Tables 3
Introduction 4
Applying the RMS Panel 5
General Description 9
Component Data 9
Microprocessor Control Board 10
Keypad/Display Boar 13
LED Status Board 14
Sensor Input Board 15
Temperature Sensors 15
Software ID 15
Software Compatibilit 16
MicroTech Monitoring and Networking Options 17
PC Monitoring 17
Network Master Panel 17
Installation 19
Panel Location and Mounting 19
Field Wiring 20
Power 21
Network Communications 21
External Chilled Water Reset Signal 25
External Demand Limiting Signal 26
Temperature Sensors 27
Remote Stop Switch or External Time Clock 28
PC Connection 29
Network Commissioning 31
Addressing the Controllers 31
Chiller Controller Setup 33
RMS Controller Setup 34
Connecting the Communications Trunk 35
Service Information 38
Wiring Diagram 38
Test Procedures 39
Status LED Diagnostics 39
Troubleshooting Power Problems 39
Troubleshooting Communications Problems 40
Troubleshooting Analog Input Problems 40
Troubleshooting the LED Status Board 42
Troubleshooting the Keypad/Display Board 43
MCB Replacement 43
Parts List 44

Illustrations

Figure 1. Primary Pump Distribution: Individual Chiller Pumps 6
Figure 2. Primary Pump Distribution: Common Chiller Pump With Isolation Valves 6
Figure 3. Primary-Secondary Pump Distribution 7
Figure 4. Primary Pump Distribution: Common Chiller Pump Without Isolation Valves 8
Figure 5. Control Panel Layout 10
Figure 6. Microprocessor Control Board (MCB) 11
Figure 7. Hex Switches 13

Figure 8. Keypad/Display Board (KDB) 14
Figure 9. LED Status Board (LSB) 14
Figure 10. Sensor Input Board (SIB)..... 15
Figure 11. Software ID Tag 16
Figure 12. RMS Panel Dimensions 20
Figure 13. Field Wiring Schematic: Reciprocating Chillers 23
Figure 14. Field Wiring Schematic: Screw Chillers 24
Figure 15. RS-232 Cable Pinouts for 9-Pin Serial Ports 30
Figure 16. RS-232 Cable Pinouts for 25-Pin Serial Ports 31
Figure 17. AMP Connector Terminal Configuration 36
Figure 18. RMS Panel Schematic Legend 38
Figure 19. MCB Power Supply Terminals 40

Tables

Table 1. MicroTech Unit Controller Installation Literature 4
Table 2. Model-Specific Chiller Installation Literature 4
Table 3. Green and Red Status LED Indication 12
Table 4. Amber Status LED Indication 12
Table 5. Program Code RMS-U13B Software Compatibilit 16
Table 6. PC Specification 17
Table 7. RMS Panel Environmental Specifications 19
Table 8. Features Requiring Temperature Inputs 27
Table 9. Network Communications Field Wiring Terminals 36
Table 10. Port B Voltages (AMP Type) 36
Table 11. Thermistor Chart 41

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Introduction

This manual provides information about the MicroTech® Remote Monitoring and Sequencing (RMS) Panel for McQuay air-cooled (ALR) and water-cooled (WHR) reciprocating and air-cooled (ALS) screw chillers. [The RMS panel cannot control water-cooled (PFS) screw chillers.] It describes the components, field wiring options and requirements, network commissioning procedures, and service procedures.

For operation and information on using and programming the MicroTech RMS Panel, refer to OM 118, *MicroTech Remote Monitoring and Sequencing Panel*. For specific information about the MicroTech chiller controllers, refer to the appropriate MicroTech unit controller installation manual (see Table 1). For installation, commissioning instructions and general information on a particula chiller, refer to its model-specific installation manual (see Table 2).

Table 1. MicroTech Unit Controller Installation Literature

Chiller Type	Installation & Maintenance Data Bulletin Number
Reciprocating	IM 493
Screw	IM 549

Table 2. Model-Specific Chiller Installation Literature

Chiller Model	Installation & Maintenance Data Bulletin Number
ALR (40–195 Tons)	IM 499
WHR (40–240 Tons)	IM 508
ALS	IM 548

⚠ WARNING

Electric shock hazard.

Can cause personal injury or equipment damage.

This equipment must be properly grounded. Connections and service to the MicroTech control panel must be performed only by personnel that are knowledgeable in the operation of th equipment being controlled.

⚠ CAUTION

Static sensitive components.

A static discharge while handling electronic circuit boards can cause damage to the components.

Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

NOTICE

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonabl protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense. **McQuay International disclaims any liability resulting from any interference or for the correction thereof.**

Applying the RMS Panel

The RMS Panel has been designed to control the four most common chiller plant configurations, which are as follows:

1. Primary Pump Distribution: Individual Chiller Pumps
2. Primary Pump Distribution: Common Chiller Pump With Isolation Valves
3. Primary-Secondary Pump Distribution
4. Primary Pump Distribution: Common Chiller Pump Without Isolation Valves

Typical, schematic representations of these configurations are shown in Figures 1 through 4. Although the RMS Panel can be used with any of these configurations, you should be aware that *with configurations 3 and 4 the temperature of the chilled water being supplied to the load may vary at part load conditions*. However, you can minimize any adverse effects by setting the RMS Panel's sequencing parameters appropriate to the application. For more information, see the "Sequencing Control" section in OM 118. Following are descriptions of these typical chiller plant configurations and guidelines for applying the RMS Panel. The McQuay chillers in these configurations can be all reciprocating, all screw, or a mixture of reciprocating and screw.

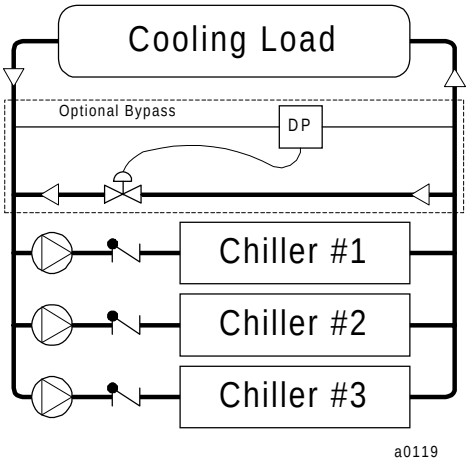
The RMS Panel may be suitable for applications other than the four listed above. If your application does not match one of these four, contact your McQuay sales representative for assistance.

Note: If two or three chillers are in an RMS Panel network, the RMS Panel will always sequence those chillers. The RMS Panel *cannot* be set up for remote monitoring only.

Primary Pump Distribution: Individual Chiller Pumps

Chiller plant configuration 1, "Primary Pump Distribution: Individual Chiller Pumps," is shown in Figure 1. The distinguishing characteristics of this configuration are: (1) two or three chillers are piped in parallel, (2) each chiller has its own primary chilled water pump, (3) the primary pumps are also used to distribute water to the cooling loads, and (4) the system may have a bypass line and a valve that is controlled by a differential pressure controller (if there is no bypass line, three-wa valves are typically used at the loads).

Figure 1. Primary Pump Distribution: Individual Chiller Pumps

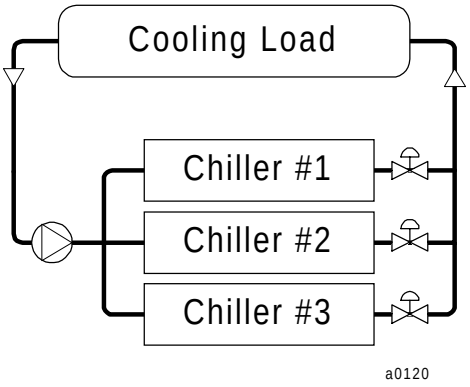


In this system, the temperature of the water entering the loads is always very close to each chiller's leaving evaporator water temperature setpoint.

Primary Pump Distribution: Common Chiller Pump With Isolation Valves

Chiller plant configuration 2, "Primary Pump Distribution: Common Chiller Pump With Isolation Valves," is shown in Figure 2. The distinguishing characteristics of this configuration are as follows: (1) two or three chillers are piped in parallel, (2) a common primary chilled water pump serves all chillers, (3) the primary pump is also used to distribute water to the cooling loads, and (4) each chiller has its own two-position isolation valve that is closed when the chiller is off.

Figure 2. Primary Pump Distribution: Common Chiller Pump With Isolation Valves



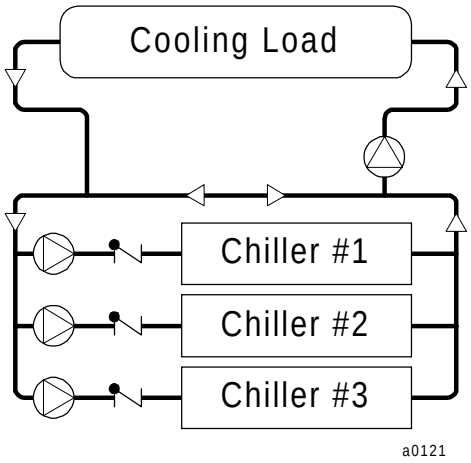
In this system, the temperature of the water entering the loads is always very close to each chiller's leaving evaporator water temperature setpoint.

Caution: Significant changes in the chilled water flow rate through the evaporators can result when the chillers in this configuration are turned on and off. Large flow rate changes can cause erratic chiller control.

Primary-Secondary Pump Distribution

Chiller plant configuration 3, "Primary-Secondary Pump Distribution," is shown in Figure 3. The distinguishing characteristics of this configuration are: (1) two or three chillers are piped in parallel, (2) each chiller has its own primary chilled water pump, (3) one or more secondary pumps are used to distribute water to the cooling loads, and (4) the secondary circuit is hydraulically isolated from the primary circuit by a decoupler line.

Figure 3. Primary-Secondary Pump Distribution



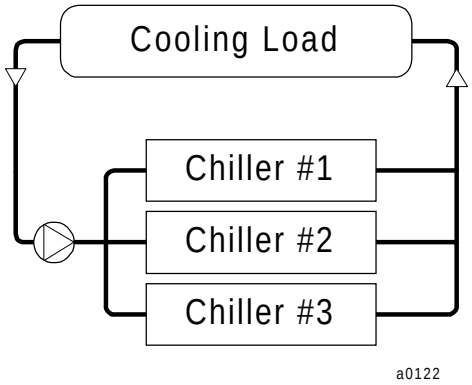
In this system, the temperature of the water entering the loads depends upon the direction of flow in the decoupler line. If the flow rate in the primary circuit is higher than the flow rate in the secondary circuit (decoupler arrow to the left in Figure 3), the temperature will be very close to each chiller's leaving evaporator water temperature setpoint. If the flow rate in the secondary circuit is higher than the flow rate in the primary circuit (decoupler arrow to the right in Figure 3), the temperature will be higher than each chiller's leaving evaporator water temperature setpoint because the supply and return water mix.

Typically, the flow rate in the secondary circuit is higher than the flow rate in the primary circuit at part load conditions; for example, when only one chiller is on. Typically, the flow rate in the primary circuit is higher than the flow rate in the secondary circuit at full load conditions; fo example, when all chillers are on. The primary and secondary flow rates can be equalized if a variable-speed secondary pump is used or if multiple sequenced secondary pumps are used, but note that *the RMS Panel cannot perform these types of secondary pump control.*

Primary Pump Distribution: Common Chiller Pump Without Isolation Valves

Chiller plant configuration 4, "Primary Pump Distribution: Common Chiller Pump Without Isolation Valves," is shown in Figure 4. The distinguishing characteristics of this configuration are: (1) two or three chillers are piped in parallel, (2) a common primary chilled water pump serves all chillers, (3) the primary pump is also used to distribute water to the cooling loads, and (4) wate always flows through each chiller regardless of whether it is on or off.

Figure 4. Primary Pump Distribution: Common Chiller Pump Without Isolation Valves



In this system, the temperature of the water entering the loads depends upon the number of operational chillers. If all chillers are on, the temperature is very close to each chiller's leaving evaporator water temperature setpoint. If some chillers are on and some are off, the temperature is higher than each chiller's leaving evaporator water temperature setpoint because the cooler wate leaving the active chiller(s) mixes with the warmer water leaving the inactive chiller(s).

General Description

The MicroTech Remote Monitoring and Sequencing (RMS) Panel is a microprocessor-based controller designed to provide sophisticated control of up to three MicroTech equipped air-cooled (ALR) or water-cooled (WHR) reciprocating chillers or air-cooled (ALS) screw chillers. In addition to providing remote chiller monitoring via network communications, the RMS controller is capable of sequencing two or three chillers as the cooling load varies. An automatic lead-lag selection ensures that chiller run-times are equalized.

A 12-key keypad and a 2-line by 16-character display give you access to the RMS controller's status information, setpoints, control parameters, alarm messages, and schedules. With a special keystroke combination, the RMS Panel's keypad/display can emulate any chiller's keypad/ display. The controller includes password protection to protect against unauthorized or accidental setpoint o parameter changes.

The RMS Panel is capable of performing all network communications required for complete, stand-alone chiller plant control (see note below). If desired, it can be incorporated into a MicroTech network that includes a Network Master Panel (NMP) and other MicroTech controllers. In eithe case, an IBM® compatible computer running MicroTech Monitor™ software can be connected to give you full-screen monitoring and control capability. The computer can be connected directly o remotely via telephone lines using a modem (optional).

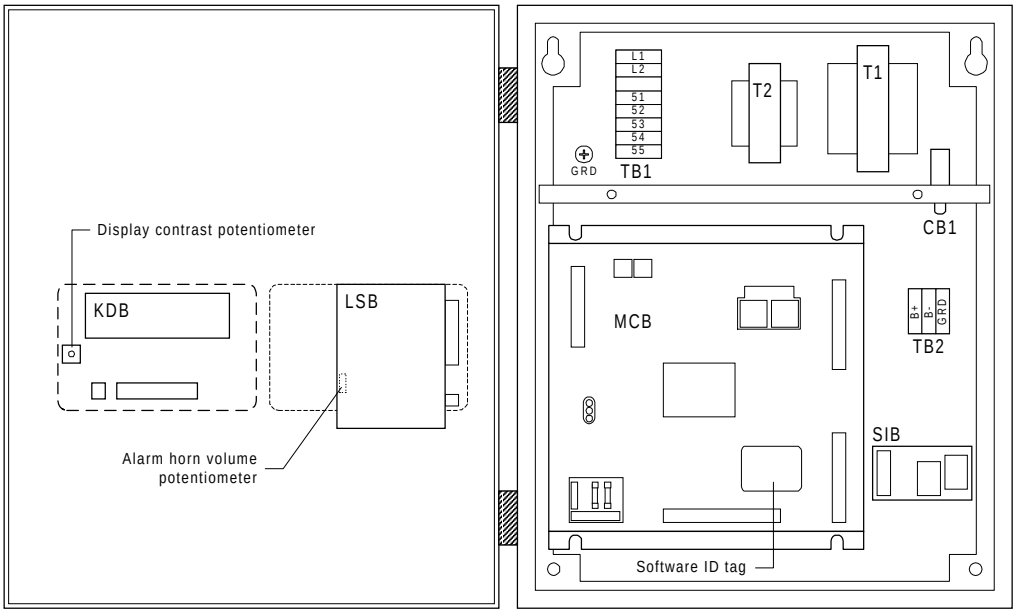
Note: As used throughout this manual, the term "chiller plant" denotes the RMS Panel and its associated chillers; it would not include, for example, a cooling tower system controlled by a MicroTech Application Specific Controller.

Component Data

The control panel layout for the RMS Panel is shown in Figure 5. The main components of the system are the Microprocessor Control Board (MCB), the Keypad/Display Board (KDB), and the LED Status Board (LSB). The Sensor Input Board (SIB) is an optional accessory that is included with the MicroTech RMS Sensor Kit. It is required to connect zone and outdoor air temperature sensors to the controller. All of these major components are mounted inside a standard NEMA 1 enclosure. They are interconnected by ribbon cables, shielded multi-conductor cables, or discrete wiring. Power for the system is provided by transformers T1 and T2.

Following are descriptions of these MicroTech components and their input and output devices.

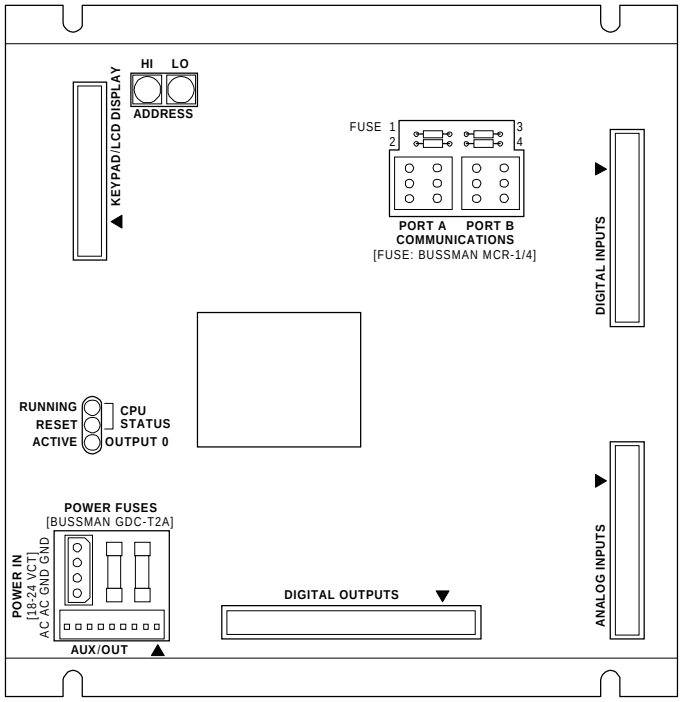
Figure 5. Control Panel Layout



Microprocessor Control Board

The Microprocessor Control Board (MCB) is shown in Figure 6. It contains a microprocessor that is preprogrammed with the software required to monitor and control up to three chillers. The MC coordinates all communications between the RMS controller and the chiller controllers. When appropriate, it enables and disables chillers as required by its schedule, the current lead-lag configuration, and the cooling load.

Figure 6. Microprocessor Control Board (MCB)



Analog Inputs Connection

The MCB receives conditioned analog inputs from the Sensor Input Board through the Analog Inputs port via a plug-in ribbon cable. These inputs are 0–5 Vdc analog signals.

Digital Outputs Connection

After processing all input conditions and network data, the MCB sends the appropriate output signals to the LED Status Board through the Digital Outputs port via a plug-in ribbon cable.

Aux/Out Terminal Strip

The Aux/Out terminal strip provides 12 Vdc power to the LED Status Board and 5 Vdc power to the back light on the Keypad/Display Board. Refer to the panel's wiring diagram or Figure 19 for more information.

Power In Terminal Strip

The MCB receives 18 Vac, center-tapped power from transformer T2 through the Power In terminal strip. This power drives all logic and communications circuitry, the Aux/Out terminal strip, the LED Status Board, and the Keypad/Display Board. Refer to the panel's wiring diagram or Figure 19 for more information.

Power Fuses

Two identical 2-amp fuses are located to the right of the Power In terminal strip. These fuses are in the MCB power supply circuit.

Microprocessor Status LEDs

The green, red, and amber LEDs on the MCB provide information about the operating status of the microprocessor. The amber LED also indicates the existence of alarm conditions in the chille network. (The Alarm LED on the LSB board also does this.)

Following is the normal start-up sequence that the three status LEDs should follow when power is applied to the MCB:

1. The red ("Reset") LED turns on and remains on for approximately 5 seconds. During this period the MCB performs a self-test.
2. The red LED turns off and the green ("Running") LED turns on. This indicates that the microprocessor has passed the self-test and is functioning properly.
3. The amber ("Active") LED remains off continually if no alarm conditions exist in the chille network. If alarm conditions exist, the amber LED will flash as shown in Table 4.

If the above sequence does not occur after power is applied to the controller, there is a problem with the MCB or its power supply. For more information, refer to the "Test Procedures" section of this manual, which is under "Service Information."

Tables 3 and 4 summarize the green, red, and amber status LED indications.

Table 3. Green and Red Status LED Indication

Green LED State	Red LED State	Indication
Off	Off	No power to MCB
Off	On*	Self-test failure or power supply problem
On	Off	MCB operating normally

* For longer than 5 seconds.

Table 4. Amber Status LED Indication

Amber LED State	Indication
Off	Normal operation
On 1/2 second; Off 1/2 second	Alarm condition

Keypad/LCD Display Connection

The MCB receives input commands and operating parameters from the keypad and sends requested information to the display through the Keypad/LCD Display port via a plug-in ribbon cable.

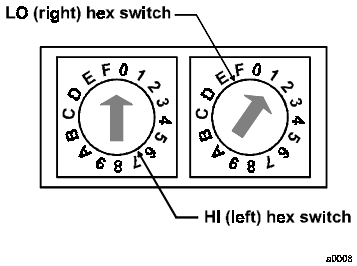
Hex Switches

The MCB includes two hex (hexadecimal) switches that indicate the RMS controller's network address.

The HI and LO hex switches are shown in Figure 7. A "hex switch setting" is defined as the HI switch digit followed by the LO switch digit. For example, a hex switch setting of 2F would have the HI switch set to "2" and the LO switch set to "F." Typically, the RMS controller's hex switch setting should be 00. Refer to "Addressing the Controllers" in the "Network Commissioning" section of this manual for more information.

Note: You can change the setting of a hex switch with a slotted-blade screwdriver that has a $^{3}/_{32}$-inch tip. If a hex switch setting is changed, power to the MCB must be cycled in order to enter the new setting into memory. This can be done by opening and then closing the push button circuit breaker (CB1) in the panel.

Figure 7. Hex Switches



Communication Ports

The MCB has two communication ports: port A and port B. Each port has six terminals and is set up for both the RS-232C and RS-485 data transmission interface standards. The male and female connectors for these ports are manufactured by AMP. Therefore, they are referred to as "AMP plugs" or "AMP connectors" throughout this manual. Socketed fuses located next to the ports protect the communications drivers from voltage in excess of ±12 V. Following are brief descriptions of each port's function.

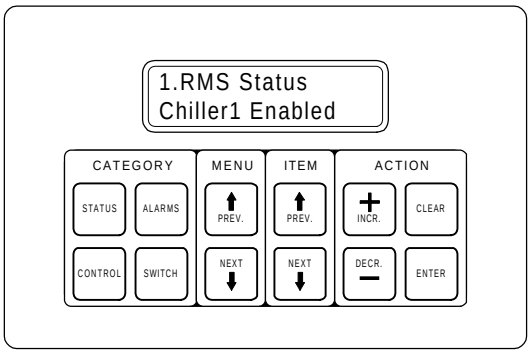
Port A Port A is for communications with an IBM compatible PC using the RS-232C interface standard. The PC can be directly connected, over a limited distance, with a twisted, shielded pair cable, or it can be remotely connected via phone lines with a modem. (Port A can also be used to connect a licensed building automation system to the MicroTech network via Open Protocol.) The default communications rate is 9600 bps. For more information, see "PC Connection" in the "Field Wiring" section of this manual.

Port B Port B is for MicroTech network communications using the RS-485 interface standard. A twisted, shielded pair cable should be connected to port B via terminals B+, B–, and GND on terminal block TB2. The communications rate is 9600 bps. For more information, see "Network Communications" in the "Field Wiring" section of this manual.

Keypad/Display Board

The Keypad/Display Board (KDB) gives you a local interface with the RMS controller and a remote interface with the chiller controllers. All operating conditions, system alarms, control parameters, and schedules can be monitored from the display. If the password has been entered, any adjustable parameter or schedule can be modified with the keypad. Because the display is backlit, the liquid-crystal characters are highly visible regardless of the ambient light level. You can adjust the displa contrast with a small pot located on the back of the board (see Figure 5). For information on using the keypad/display, refer to the "Getting Started" portion of OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

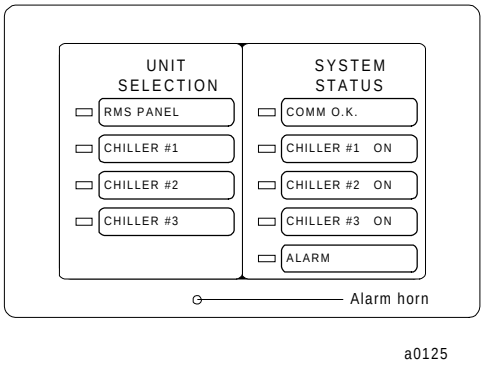
Figure 8. Keypad/Display Board (KDB)



LED Status Board

The LED Status Board (LSB), which includes two sets of LEDs and an alarm horn, allows you to quickly determine overall chiller plant status. It is shown in Figure 9.

Figure 9. LED Status Board (LSB)



Unit Selection Indicators

Four Unit Selection LEDs clearly indicate which chiller the RMS Panel's keypad/display is emulating. For example, if the "Chiller #1" Unit Selection LED is lit, the RMS Panel's keypad/display acts exactly as if it were the keypad/display at Chiller #1. A combination of keystrokes allow you to change controllers.

System Status Indicators

Five System Status LEDs show the overall status of the chiller plant.

Communications LED The "Comm O.K." LED is on continually when communications with all chillers is normal. If the RMS detects a communication problem with an chiller, the LED flashes. The flashing rate depends on the number of chillers communicating. For example, if communications are lost with one chiller in a three chiller network, the LED flashes one-third of the time.

Chiller On LEDs The "Chiller #1 On," "Chiller #2 On," and "Chiller #3 On" LEDs indicate at a glance which chillers are currently in a cooling mode of operation. If an LED is lit, that chiller is operating at stage 1 or higher.

Alarm LED The red "Alarm" LED will blink whenever there is an alarm in the RMS

Panel or any of the chillers. This occurs regardless of the current selection.

Alarm Horn

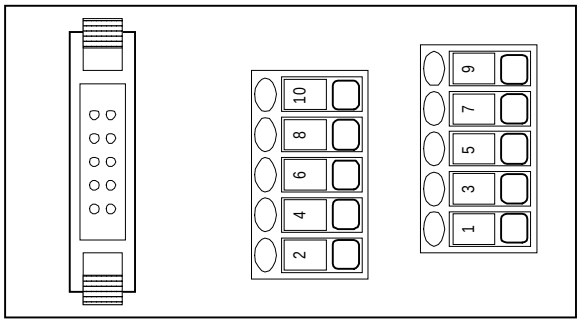
If it is enabled, the piezo alarm annunciator (alarm horn) sounds whenever an alarm occurs in the RMS Panel or any of the chillers. This occurs regardless of the current unit selection. To silence the alarm horn, press the ALARMS key while the RMS Panel is the selected controller. You can adjust the alarm horn's volume with a small pot located on the LSB board. You can also set up the horn so that it sounds only when certain types of alarms occur (comm loss, faults, or problems). For more information, refer to the "Alarm Monitoring" section of OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

Note: Silencing the alarm horn does not clear an alarm. To clear an alarm from the RMS Panel you must first select the chiller with the alarm and then clear it. For more information, refer to the "Alarm Monitoring" section of OM 118.

Sensor Input Board

The Sensor Input Board (SIB) is included in the optional RMS Sensor Kit (part no. 0057186701). It collects the zone and outdoor air temperature sensor signals, converts them into 0–5 VDC signals, and sends them to the MCB via a plug-in ribbon cable.

Figure 10. Sensor Input Board (SIB)



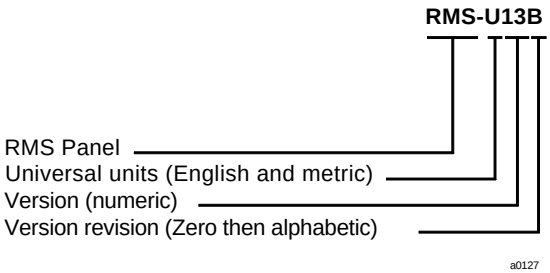
Temperature Sensors

The RMS controller uses negative temperature coefficient thermistors for temperature sensing. A thermistor chart, which provides voltage-to-temperature and resistance-to-temperature conversion data (Table 11), is included in the "Test Procedures" section of this manual.

Software ID

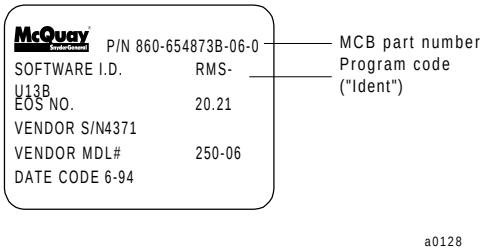
MicroTech RMS controller software is factory installed and tested in each panel prior to shipment. The software is identified by a program code (also referred to as the "Ident"), which is printed on a small label affixed to the MCB. An example of this label is shown in Figure 11. The program code is also encoded in the controller's memory and is available for display on menu 21 of the keypad/display or a PC equipped with Monitor software. Using menu 21 or Monitor software is the most reliable way of determining the controller's program code.

RMS controller program codification is as follows:



This edition documents revision E of the standard RMS Panel software and all subsequent revisions of version 14 until otherwise indicated. If your RMS Panel software has a later revision code (fo example, RMS-U14F), some of the information in this manual may apply. However, since only very minor software changes are considered revisions, any differences should be insignificant.

Figure 11. Software ID Tag



Software Compatibility

This version is *not* compatible with some earlier versions of standard MicroTech reciprocating and two-compressor screw chiller controller software, and it is not compatible with any version of standard three-compressor screw chiller controller software. The current software compatibility is summarized in Table 5. The wildcard character (∗) can be any character.

Table 5. Program Code RMS-U13B Software Compatibility

Chiller Type	Compatible Programs	Incompatible Programs
Reciprocating	RCP**01A	None
	AWR-*12E	AWR-*12D and earlier
	CR*EM*6H CR*EM*1H	CR*EM*6G CR*EM*1G
	XR*EM*6H XR*EM*1H	XR*EM*6G XR*EM*1G
Screw	SC1**01A	None
	SC2**17D through 17I SC2**180 through 18C	SC2**17C and earlier
	SC3**19A	SC3**18C
	SC4**19A	SC4**18C

Note: The RMS Panel is compatible with the current version of reciprocating chillers made in Cecchina, Italy. These chillers support English and other languages, but the RMS panel has an English only keypad/display. The RMS displays all messages in English.

If you want to use an RMS Panel with older chillers that have incompatible standard software, the chiller software must be upgraded. If you have a version of chiller software that is later than the compatible programs shown in Table 5, it is likely that this version is compatible with it; however, it may not be. To find out for sure, contact McQuayService.

MicroTech Monitoring and Networking Options

PC Monitoring

A PC (personal computer) equipped with the appropriate Monitor software can be used to provide a high-level interface with a MicroTech network (see PC specification below). Monitor software features a high resolution graphic display, multilevel password access, and advanced trend-logging. The PC can be connected to the RMS controller either directly, via a single twisted, shielded pai cable, or remotely, via phone lines with an optional modem. For more information on connecting the PC to the controller, refer to "PC Connection" in the "Field Wiring" section of this manual.

For the most convenience and best operation, the PC should be considered dedicated to the MicroTech system. However, you can exit the Monitor program to perform other tasks without affecting equipment control. Refer to the user's manual supplied with the Monitor software fo additional information.

PC Specification

A direct or remote connected computer can be used for monitoring RMS Panel and chille operation, changing setpoints, scheduling, trend logging, downloading software, and diagnostics. The PC must be an IBM or 100% true compatible. Table 6 shows the preferred and minimum PC specifications.

Network Master Panel

The MicroTech Network Master Panel (NMP) allows the RMS controller and its associated chillers to be incorporated into a building-wide network with other MicroTech unit and auxiliary controllers. In conjunction with a PC and Monitor software, it gives the building operator the capability to perform advanced equipment control and monitoring from a central or remote location. The following features are provided by the optional NMP:

- Remote unit monitoring
- Advanced scheduling features
- Advanced alarm management
- Global operator override by unit type
- Demand metering
- Historical electrical data logging

For further information, contact your McQuay sales representative.

Table 6. PC Specification

Preferred Configuration	Minimum Configuration
486DX processor, 66MHz or better	386SX processor, 16 MHz
8 MB of RAM	4 MB of RAM
120 MB hard disk drive or better	60 MB hard disk drive
3½" floppy disk drive	3½" floppy disk drive
Serial port (9 pin male; Com1 or Com2)	Serial port (9 or 25 pin male; Com1 or Com2)
Parallel port	–
Internal time clock, battery backed	Internal time clock, battery backed
Super VGA graphics capability	VGA graphics capability

Preferred Configuration	Minimum Configuration
Super VGA monitor	VGA monitor
Printer	–
Bus mouse or trackball	Serial mouse or trackball*
101 enhanced keyboard	101 enhanced keyboard
9600 bps modem, compatible with the AT command set (optional)	1200 bps modem, compatible with the AT command set (optional)
MS-DOS® 6.2 or higher	MS-DOS® 5.0
Microsoft® Windows™ 3.1 or higher	Microsoft® Windows™ 3.1
MicroTech® Monitor™ software	MicroTech® Monitor™ software

* If a serial pointing device is used, there must be another serial port (Com1 or Com2) available for connecting the PC to the MicroTech controller.

Panel Location and Mounting

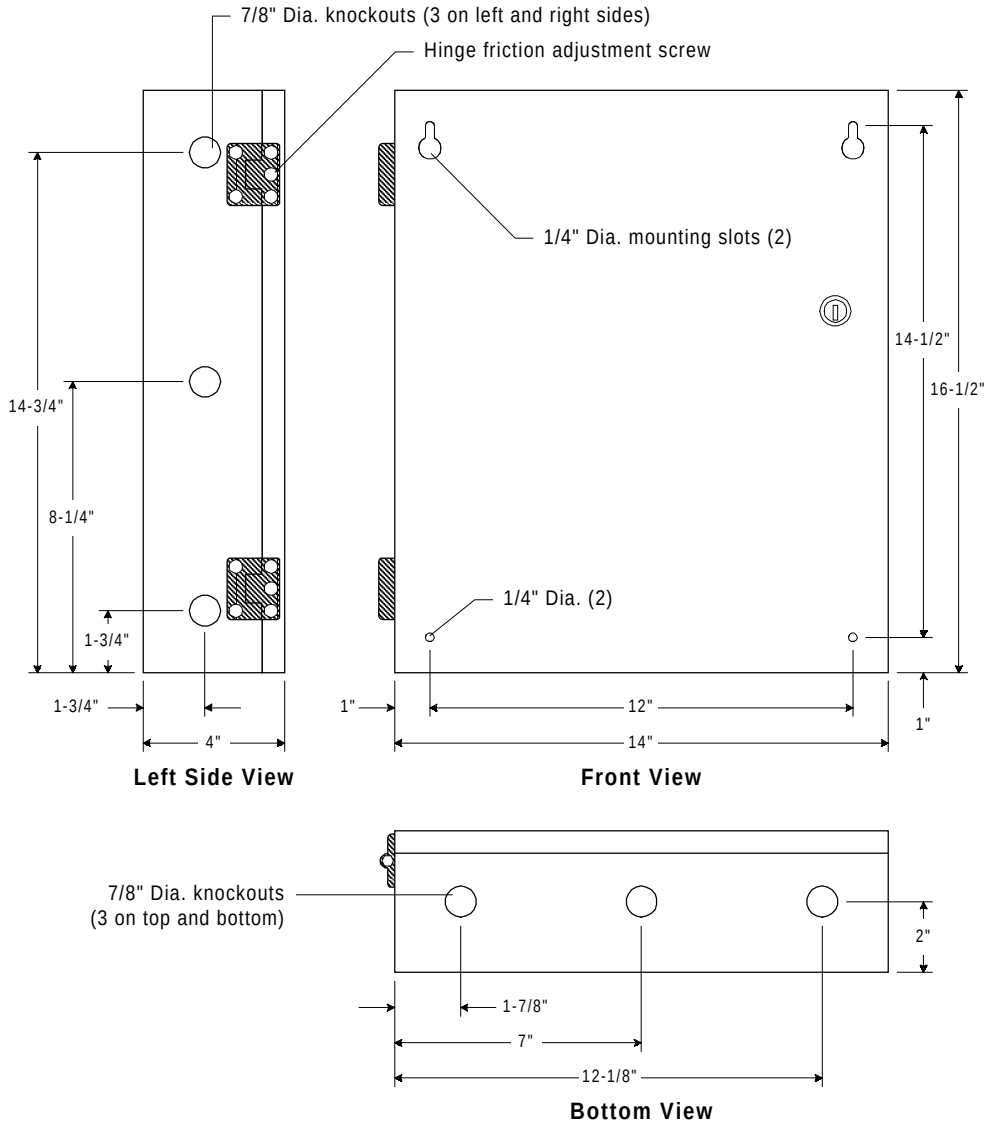
The RMS Panel is suitable for indoor use only. Table 7 lists the allowable temperature and humidit ranges. Locate the panel at a convenient height for operation of the keypad/display, and allow adequate clearance for the door swing. Mount the panel to the wall with screws or bolts. It weighs 40 pounds. Fou ¼-inch openings are provided at the corners of the panel. Panel dimensions are shown in Figure 12.

The RMS Panel is equipped with special door hinges that have a friction adjustment screw. By adjusting this screw you can prevent the panel door from swinging open or closed unexpectedly.

Table 7. RMS Panel Environmental Specifications

Panel State	Temperature	Relative Humidity
Operating	32 – 100°F	0 – 95%
In storage	–40 – 140°F	0 – 95%

Figure 12. RMS Panel Dimensions



Field Wiring

Following are descriptions of the various field wiring requirements and options. Some RMS controller features require field wiring to implement; refer to the job plans and specifications. All possible field wiring connections are shown in Figures 13 and 14. Wiring must comply with the National Electrical Code and all local codes and ordinances. The warranty is void if wiring is not in accordance with these instructions.

The panel is divided into high and low voltage sections by a sheet metal barrier. The power wiring should enter the high voltage section. The temperature sensor wiring (if any) and the network wiring should enter the low voltage section. Wiring penetrations must be made only through the ⅞-inch knockouts provided.

As shown in Figures 13 and 14, a typical chiller plant has the same type of chillers in it; however, this is not required. The RMS Panel can control a mixture of McQuay reciprocating and scre chillers.

Power

⚠ WARNING

Electric shock hazard.

Can cause personal injury or death.

This equipment must be properly grounded. All protective deadfront panels must be reinstalled and secured when power wiring is complete.

The RMS Panel requires a 115 Vac power supply, which should be connected to terminals L1 and L2 in the high voltage section of the panel. The panel must be properly grounded by connecting the ground lug (GRD) to earth ground. Refer to Figure 13 or 14. Power wiring must be sized to carry at least 5 amps.

To gain access to the high voltage section, remove the deadfront barrier. It is attached to the panel with two $^{5}/_{16}$-inch hex screws. Replace this deadfront when the wiring is complete.

The panel is internally protected with a 0.5-amp circuit breaker (CB1), which is located inside the panel on the underside of the high voltage section (see Figure 5). This push-button circuit breake can also be used as an on-off switch for the panel. When the push button is in, the panel should be energized. When the push button is out, the panel should be de-energized. Note that a white ring on the switch shaft is visible when the push button is out.

Network Communications

For network communications to occur, a twisted, shielded pair cable must be connected between the RMS Panel, its associated chillers, and any other MicroTech unit or auxiliary controllers. This interconnecting, "daisy-chain" wiring is shown in Figures 13 and 14. Network communications is accomplished using the RS-485 interface standard at 9600 bps.

The typical network configuration, which is shown in Figures 13 and 14, consists of the RMS Panel and one, two, or three chillers. Unusual applications may include other MicroTech controllers; fo example, a Network Master Panel, Application Specific Controllers, or Unit Ventilator Controllers.

About MicroTech Network Architecture

All controllers in a MicroTech network are assigned a "level": level 1, level 2, or level 3. All networks must have one level-1 controller to coordinate communications. Multiple level-2 controllers can be connected to the level-1 controller with a communications "trunk," an isolated section of the daisy-chained network wiring. (The network wiring between all controllers shown in Figure 13 is a trunk.) Multiple level-3 controllers can be connected to a level-2 controller with a separate trunk. *The maximum allowable length of a communications trunk is 5000 feet.*

For the typical network in which there is one RMS Panel and no Network Master Panel, the RMS Panel is the level-1 controller and the chillers are level-2 controllers (this is the default factory setup). If a Network Master Panel is included in the network, it is the level-1 controller and the RMS Panel and the chillers are level-2 controllers. Unless there are many water source heat pumps or unit ventilators in the network, there usually are not any level-3 controllers.

Cable Specification

The network communications cable must meet the following minimum requirements: twisted, shielded pair with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC oute jacket (Belden 8762 or equivalent). Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Note: Ideally, one continuous piece of cable should connect any two controllers. This reduces the risk of communications errors. If the cable must be spliced, use crimp-type butt connectors (better) or solder (best). Do not use wire nuts.

Wiring Instructions

Regardless of whether the RMS controller is level 1 or level 2, the network connection to the RMS and chiller controllers is at port B on the MCBs. As shown in Figures 13 and 14, field wiring to port B on these controllers can be accomplished by connecting the network cable to terminals B–, B+, and GND in the RMS Panel; terminals 137, 138, and 139 in each reciprocating chiller panel; and terminals 53, 54, and 55 in each screw chiller panel.

The chiller designations shown in Figures 13 and 14 ("Chiller #1," "Chiller #2," "Chiller #3"), are established by the network address, not the physical position of the chiller in the daisy chain. The networked controllers can be wired in any order. For example, the RMS controller could be connected between Chiller #1 and Chiller #2. *It is highly recommended that the installing contractor keep track of the physical order of the controllers on the daisy-chained trunk* . This will facilitate troubleshooting any network communications problems that may occur. For more on the network address, see "Addressing the Controllers" in the "Network Commissioning" section of this manual.

Use the following procedure to perform the network wiring:

1. Before beginning, verify that the port B plug is disconnected from every controller on the communications trunk being wired. These plugs are connected during the commissioning procedure. This is a precaution to prevent stray high voltage from damaging the controllers. Any voltage in excess of 12 V can damage the board's communications drivers.

Figure 13. Field Wiring Schematic: Reciprocating Chillers

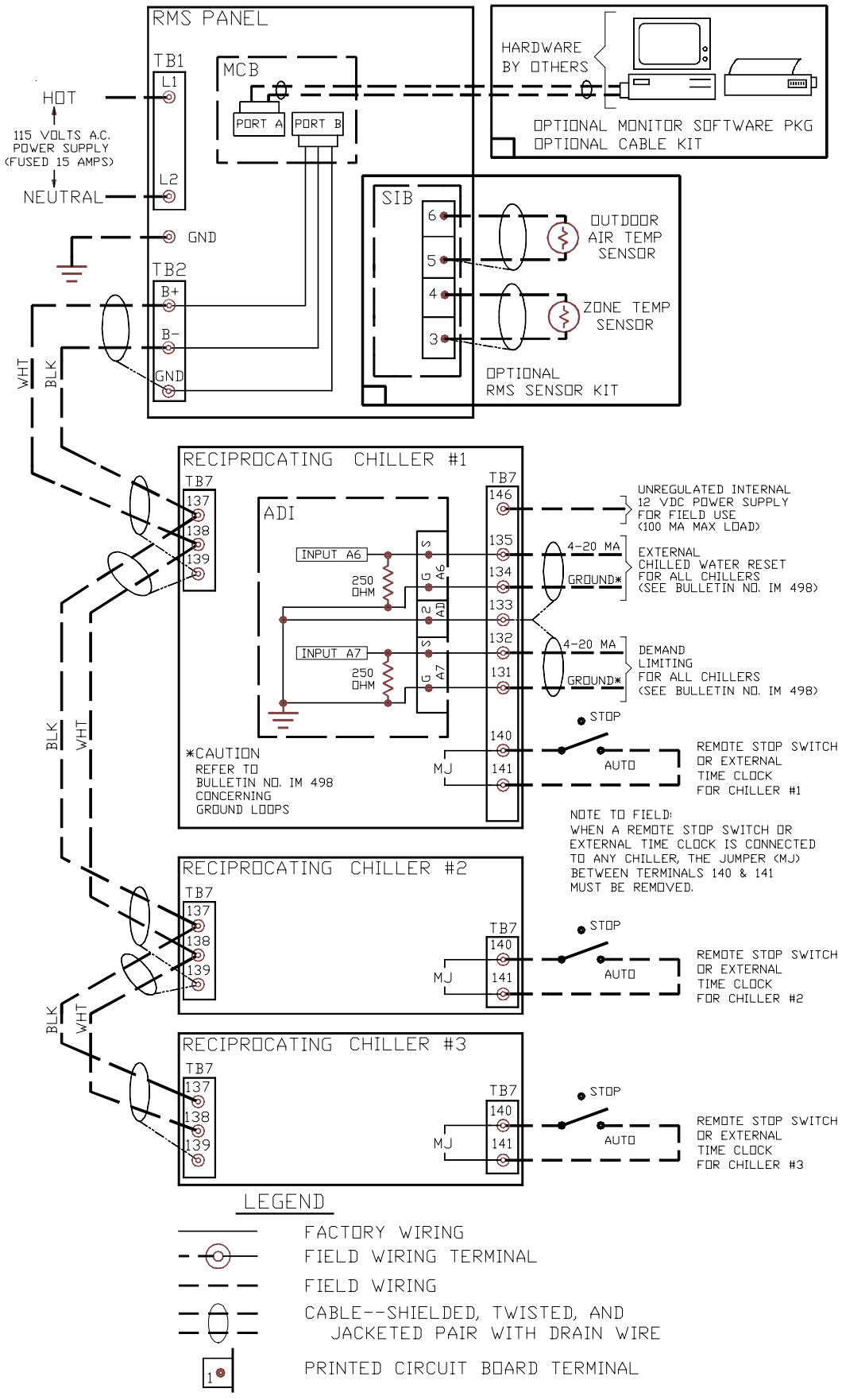
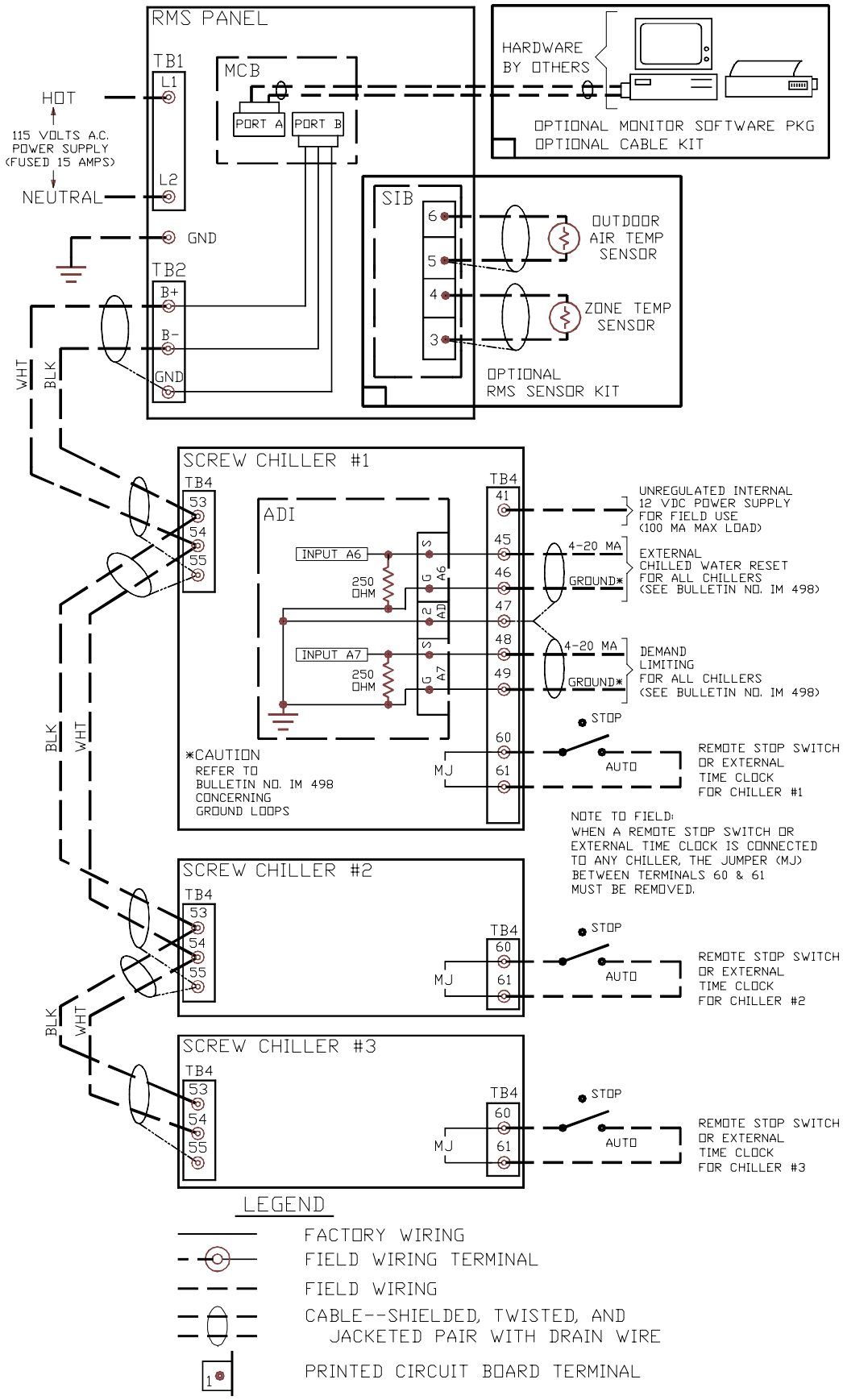


Figure 14. Field Wiring Schematic: Screw Chillers



2. Connect the network cable in a daisy-chain manner as shown in Figures 13 and 14. Use caution to assure that the correct polarity is maintained at each controller. Be sure to connect each cable's shield to the controllers as shown in the figures. Like the positive (+) and negative (–) conductors, the shield (ground) conductor must be continuous over the trunk.
3. If a Network Master Panel is included in the network, connect its B port to the trunk in a similar fashion.

External Chilled Water Reset Signal

⚠ CAUTION

Ground loop current hazard.

Can cause equipment damage.

The external reset signal must be isolated from any ground other than the MicroTech controller chassis ground. If it is not, ground loop currents could occur which could damage th MicroTech controller. If the device or system providing the external reset signal is connected to a ground other than the MicroTech controller chassis, be sure that it is providing an isolated output, or condition the output with a signal isolator.

For chillers included in an RMS network, there are two optional chilled water temperature reset methods available: outside air temperature and external 4–20 mA signal. (The "return" and "ice" reset methods, which are available with stand-alone chillers, cannot be used with chillers in an RMS network.) Either of these methods or no reset can be selected at the RMS controller keypad or PC. The external reset option requires field wiring to implement.

If you select the external reset option, it linearly resets each chiller's leaving evaporator wate temperature setpoint as the input signal varies between 4 and 20 mA. At 4 mA and below, there is no reset. At 20 mA, the leaving evaporator water temperature setpoint is increased by the maximum amount possible (this amount is keypad or PC adjustable). For more on reset, refer to "Chilled Water Reset" in the "Chiller Plant Control Features" section of OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

Cable Specification

The cable for the external chilled water reset signal must meet the following minimum requirements: twisted, shielded with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket. Depending on the application, either two conductors (Belden 8762 or equivalent) or three conductors (Belden 8772 or equivalent) are required. Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Wiring Instructions

As shown in Figures 13 and 14, the external reset signal must be field wired to Chiller #1. (The "Chiller #1" designation is established by the network address, not the physical position of the chiller in the daisy chain. See "Addressing the Controllers" in the "Network Commissioning" section of this manual for more information.) The RMS controller is programmed to continuousl read the reset signal from Chiller #1 and pass it to the other chillers via network communications.

Because there are many different devices that can provide an external signal, no attempt is made here to cover every possible application. Instead, enough information about the MicroTech controller is presented so that a compatible output device can be selected and wired properly. *McQuay International is not responsible for MicroTech controller damage that occurs as a result of misapplication of a field supplied device.*

The MCB in the chiller controller is designed to accept 0–5 Vdc analog input signals. The chiller's Analog/Digital Input (ADI) board conditions all inputs before they enter the MCB. The external reset signal, which enters the ADI board at input A6, is conditioned with a 250 ohm resistor. This on-board resistor is connected between the "S" (signal) terminal and "G" (ground) terminal of input A6. Note that the "G" terminal is earth ground (see caution above). This input arrangement converts a 4-20 mA signal to a 1–5 VDC signal. The maximum allowable voltage at the "S" terminal is ±30 V.

If desired, an unregulated 12 VDC power supply on the chiller's MCB can be used to power the reset signal output device. *If this power supply is used, the total external load cannot exceed 100 mA.*

Reciprocating Chiller Refer to Figure 13. Wire the reset signal to the terminals appropriate fo the application. In all cases, connect the shield to terminal 133 (ground) and the varying signal to terminal 135 (ADI terminal "S"). Connections to terminal 146 (12 VDC power supply) and terminal 134 (ADI terminal "G") may not be required. For additional information, see the unit wiring diagram and IM 493, *MicroTech Reciprocating Chiller Controller*.

Screw Chiller Refer to Figure 14. Wire the reset signal to the terminals appropriate fo the application. In all cases, connect the shield to terminal 47 (ground) and the varying signal to terminal 45 (ADI terminal "S"). Connections to terminal 41 (12 VDC power supply) and terminal 46 (ADI terminal "G") may not be required. For additional information, see the unit wiring diagram and IM 549, *MicroTech Screw Chiller Controller*.

External Demand Limiting Signal

⚠ CAUTION

Ground loop current hazard.

Can cause equipment damage.

The external demand limiting signal must be isolated from any ground other than th MicroTech controller chassis ground. If it is not, ground loop currents could occur which could damage the MicroTech controller. If the device or system providing the external demand limiting signal is connected to a ground other than the MicroTech controller chassis, be sur that it is providing an isolated output, or condition the output with a signal isolator.

If you want, an external 4–20 mA signal can be used to provide demand limiting for all chillers included in an RMS network. The external demand limiting option requires field wiring to implement.

As the demand limiting signal varies between 4 and 20 mA, the maximum number of stages available in each chiller varies. At 4 mA and below, all chiller stages are available. At 20 mA, onl one stage is available. Between 4 and 20 mA, the number of available stages varies according to a step function. The step function used depends on the total number of stages the chiller is equipped with. For more information, refer to "Demand Limiting" in the "Chiller Plant Control Features" section of OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

Cable Specification

The cable for the external demand limiting signal must meet the following minimum requirements: twisted, shielded with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC oute jacket. Depending on the application, either two conductors (Belden 8762 or equivalent) or three conductors (Belden 8772 or equivalent) are required. Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with powe wiring.

Wiring Instructions

As shown in Figures 13 and 14, the external demand limiting signal must be field wired to Chille #1. (The "Chiller #1" designation is established by the network address, not the physical position of the chiller in the daisy chain. See "Addressing the Controllers" in the "Network Commissioning" section of this manual for more information.) The RMS controller is programmed to continuousl read the demand limiting signal from Chiller #1 and pass it to the other chillers via the network.

Because there are many different devices that can provide an external signal, no attempt is made here to cover every possible application. Instead, enough information about the MicroTech controller is presented so that a compatible output device can be selected and wired properly. *McQuay International is not responsible for MicroTech controller damage that occurs as a result of misapplication of a field supplied device.*

The MCB in the chiller controller is designed to accept 0–5 Vdc analog input signals. The chiller's Analog/Digital Input (ADI) board conditions all inputs before they enter the MCB. The external demand limiting signal, which enters the ADI board at input A7, is conditioned with a 250 ohm resistor. This on-board resistor is connected between the "S" (signal) terminal and "G" (ground) terminal of input A7. Note that the "G" terminal is earth ground (see caution above). This input arrangement converts a 4–20 mA signal to a 1–5 VDC signal. The maximum allowable voltage at the "S" terminal is ±30 V.

If you want, an unregulated 12 VDC power supply on the chiller's MCB can be used to power the demand limiting signal output device. *If this power supply is used, the total external load cannot exceed 100 mA.*

Reciprocating Chiller Refer to Figure 13. Wire the demand limiting signal to the terminals appropriate for the application. In all cases, connect the shield to terminal 133 (ground) and the varying signal to terminal 132 (ADI terminal "S"). Connections to terminal 146 (12 VDC power supply) and terminal 131 (ADI terminal "G") may not be required. For additional information, see the unit wiring diagram and IM 493, *MicroTech Reciprocating Chiller Controller*.

Screw Chiller Refer to Figure 14. Wire the reset signal to the terminals appropriate fo the application. In all cases, connect the shield to terminal 47 (ground) and the varying signal to terminal 48 (ADI terminal "S"). Connections to terminal 41 (12 VDC power supply) and terminal 49 (ADI terminal "G") may not be required. For additional information, see the unit wiring diagram and IM 549, *MicroTech Screw Chiller Controller*.

Temperature Sensors

The RMS controller has several standard features that require the outdoor air temperature, zone temperature, or both to implement. Table 8 summarizes these features. For more information on them, see OM 118, *MicroTech Remote Monitoring and Sequencing Panel.*

Table 8. Features Requiring Temperature Inputs

RMS Panel Feature	Zone Temperature	Outdoor Air Temperature
Optimal Start	•	•
Outdoor Air Reset		•
Low Ambient Lockout		•
Cooling degree-day Totalization		•

With the optional MicroTech RMS Sensor Kit, (part number: 0057186701) zone and outdoor ai temperature sensors can be connected to the RMS Panel. The RMS controller can read the outdoo air temperature from any associated chiller that has an outdoor air sensor connected to it. In this case, the RMS Sensor Kit is required only to connect a zone sensor for optimal start control. If none of the chillers associated with the RMS controller have outdoor air sensors, the RMS Sensor Kit must be installed to take advantage of any of the above features. The outdoor air temperature source is defined at the RMS Panel's keypad or a PC during the commissioning process.

Cable Specification

Temperature sensor cable must meet the following minimum requirements: twisted, shielded pai with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket (Belden 8762 or equivalent). Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Wiring Instructions

Installation and wiring instructions for the MicroTech RMS Sensor Kit are included in IM 501. This bulletin is included with the kit. The sensor wiring terminations are shown on the panel wiring diagram and Figures 13 and 14.

Remote Stop Switch or External Time Clock

If desired, a remote stop switch, an external time clock, or both can be wired to a digital input (D13) at each chiller. These two applications have different purposes, but the effect is the same when the digital input circuit is open: RMS Panel control is overridden and the chiller is disabled.

Twisted, shielded cable is not required for remote stop switch or external time clock wiring, but it can be used. The switch or contacts used must be rated for low voltage (24 VAC) and low current (11 mA).

Remote Stop Switch

A remote stop switch (or dry contacts) can be used to shut down an individual chiller from a remote location. A separate switch must be connected to each chiller for which remote stop capability is required. When a chiller's remote switch is opened, that chiller is disabled. As a result, the RMS controller is not able to start it if additional cooling capacity is required. When a chiller's remote switch is closed, that chiller is enabled. As a result, the RMS controller is able to start it as required to meet the cooling load (if it is not disabled for some other reason).

External Time Clock

There are several methods of switching the chiller plant between occupied and unoccupied operation. It can be done by the RMS Panel's internal schedule, an NMP schedule assigned to the RMS Panel, an operator override at the RMS Panel, or an external time clock. If an external time clock is used, it must be wired so that a separate set of dry contacts is connected to the remote stop input of each chiller. (If there are not enough poles on the time clock, use a relay.) The chiller plant is in the occupied mode when the time clock's contacts close. The chiller plant is in the unoccupied mode when the time clock's contacts open. For the external time clock to have absolute control ove chiller plant scheduling, all internal daily schedules in the RMS and chiller controllers must be set for continuous occupied operation (this is the default setting). For more information, see the "Scheduling" section of OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

Note: The optimal start feature is not available if an external time clock is used for scheduling.

Wiring Instructions

As shown in Figures 13 and 14, the remote stop switch or external time clock contacts must be field wired to each chiller (as required). After removing the factory-installed jumper, connect the switch to input D13 at terminals 140 and 141 on reciprocating chillers and terminals 60 and 61 on scre chillers. When the switch is closed, 24 Vac is applied to input D13, enabling the chiller. When the switch is open, input D13 is de-energized, disabling the chiller.

If you want both a remote stop switch and an external time clock to control a chiller, wire these two devices in series.

Caution: If you are using twisted, shielded cable, tape back the shield and drain wire on both ends of the cable. This reduces the possibility of shorts.

PC Connection

Regardless of whether the PC is connected directly or remotely via phone lines, the connection to any MicroTech controller is at port A on the MCB. It is best to connect a PC to the level-1 controller because faster data transmission result; however, a PC can be connected to any level-2 controller that does not have level-3 controllers associated with it. Either way, the PC will have access to the entire network (see note below). In the typical application, the RMS controller is level 1, the chiller controllers are level 2, and there are no level-3 controllers. See "Network Communications" above for more on network architecture.

It is possible to connect two or more PCs to the network, but only one PC can be connected to an one controller. The PC that is used most often should be connected to the level-1 controller fo better performance. For example, you may have one PC that you use at the building during the week and another PC that you use at home on weekends. In this situation, you may want to connect the on-site PC to the level-1 controller and the modem for the off-site PC to a level-2 controller.

The RMS controller's default port A communications rate is 9600 bps; however, it can be changed. For more information, see the "RMS and Chiller Controller Setup" section in OM 118, *MicroTech Remote Monitoring and Sequencing Panel*.

Note: If a PC is connected to a level-2 controller, a level1 RMS Panel must be set up to poll that level-2 controller so that the PC has access to the entire network. You can do this at the RMS controller's keypad/display by adjusting the Total Slaves parameter, which is located under menu 21, "Misc Setup." See the "RMS and Chiller Controller Setup" section in OM 118 for more information.

Direct Connection

An RS-232 communications cable kit that allows a PC to be directly connected to any MicroTech controller is available from McQuay International. The part number is 0057186802. The cable has a female DB-9 connector for connection to the PC's 9-pin serial port. (If the PC has a 25-pin serial port, obtain an adapter.) The cable length is 12 feet. If more length is required, a twisted, shielded pair cable can be spliced into the kit cable (see "Cable Specification for Direct PC Connection" below). If this is done, splice the conductors with crimp-type butt connectors (better) or solde (best). Do not use wire nuts.

The maximum allowable cable length for direct connection between the PC and a controller is 50 feet. If the desired length is over 50 feet, the MicroTech RS-232 Cable Extension Kit is required. This kit can extend the maximum allowable distance between the PC and the controller to 4000 feet. The part number is 0065487001.

Remote Connection

A voice quality, direct-dial telephone line is required for remote or off-site PC access to the network. The phone line should be terminated with a standard RJ-11 modular phone plug. A modem enables a remote or off-site PC to communicate with the networked controllers via phone lines.

A modem is a standard chiller option, but it is not an RMS Panel option. However, a modem that can be field installed in the RMS Panel (or any chiller) is available from McQuay International. The kit comes complete with a 14,400 bps modem (set up for 9600 bps) and a wiring harness. If a remote PC connection is required, it is recommended that the modem at the MicroTech controller be supplied by McQuay International.

Installation and wiring instructions for the MicroTech Modem Kit are included in IM 682. This bulletin is included with the kit.

Cable Specification for Direct PC Connection

A properly terminated, twisted, shielded pair cable is required to directly connect a PC to a MicroTech controller. The cable must meet the following minimum requirements: twisted, shielded pair with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket (Belden 8762 or equivalent). It must also be properly terminated to an AMP plug on one end and a female DB-9 or DB-25 connector on the other. See Figures 15 and 16 for cable pinouts. The AMP part numbers for the AMP connector shown in these figures are as follows: 1-480270-0 (plug) and 60617-1 (female pin terminals). This AMP plug can be connected to an RMS controller, a chille controller, or any other MicroTech controller that has the same type of AMP socket. The DB-9 or DB-25 connector is for connection to a 9-pin or 25-pin serial port on the PC. Note that some local codes or applications may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Note: A factory-assembled cable that meets this specification is provided with the PC Communications Cable Kit, which is available from McQuay International. This cable has a DB-9 connector. The part number of the kit is 0057186802.

Figure 15. RS-232 Cable Pinouts for 9-Pin Serial Ports

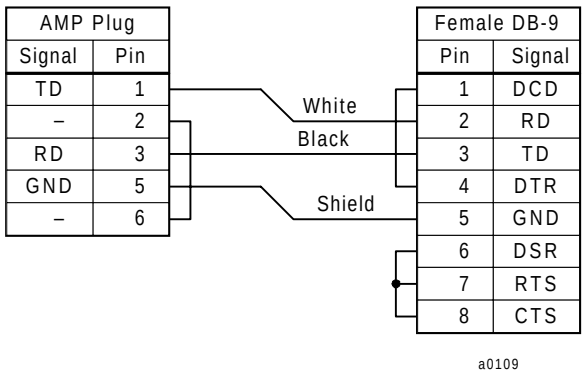
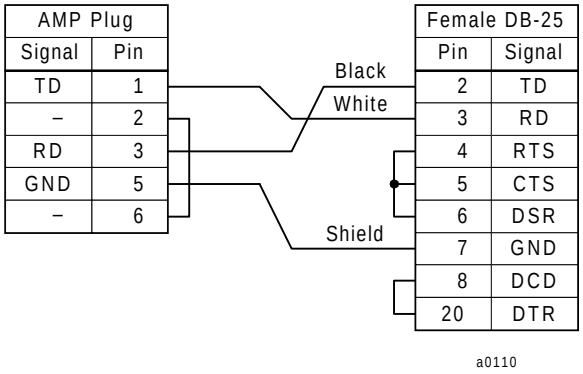


Figure 16. RS-232 Cable Pinouts for 25-Pin Serial Ports



Network Commissioning

The purpose of network commissioning is to establish and verify communications between the RMS Panel and its associated chillers. (It is not to establish and verify chiller plant *operation*.) Network commissioning can be done independently of the chiller commissioning procedures; however, *if it is done before the chillers are commissioned, care should be taken to assure that the chillers do not start.* The following instructions describe how to do this. To commission the network, you must be familiar with the operation of the keypad/display. For information, see the "Getting Started" portion of OM 118, *MicroTech Remote Monitoring and Sequencing Panel.*

Before the chiller plant is allowed to operate, the chillers must be commissioned in accordance with the instructions in the MicroTech unit controller installation literature and the model-specific chille installation literature (see Tables 1 and 2). In addition, the RMS Panel and its associated chille controllers must be set up so that they work properly together. This setup, which can be done before or after the network is commissioned, is described in OM 118.

A PC is not required to commission networks that include only RMS Panel(s) and chiller(s) because communications can be verified by observing the RMS Panel's keypad/display and LED Status Board. However, if you want to use a PC to verify network communications, you can. The PC must be equipped with MicroTech Monitor software.

Note: During the network commissioning process, all chillers must be temporarily shut down. Plan accordingly.

Addressing the Controllers

For network communications to occur, each controller in the network must have a unique network address. A controller's hex switch setting defines its network address. A chiller controller's hex switch setting also defines its chiller designation, which is used by the RMS controller for lead-lag and sequencing control; for example, "Chiller #1." For more on hex switch settings, see "Microprocessor Control Board" in the "Component Data" section of this manual.

After changing a hex switch setting, power to the MCB must be cycled to set the new address into memory. In the RMS Panel, you can do this by opening and then closing circuit breaker CB1. In the chiller controllers, you can do this by opening and then closing the circuit breaker that supplies power to the MicroTech controller (located near the MCB).

The hex switches are set differently depending on whether or not there is a Network Master Panel (NMP) or more than one RMS Panel in the network. Following are instructions on how to set them.

Note: If a chiller is running, you should shut it down before removing power from the chille controller. Do this by placing the Circuit No. 1 and Circuit No. 2 switches in the “Pumpdown and Stop” position.

The Typical Network

The typical RMS network includes one RMS Panel and one, two, or three chillers. It may also include other level-2 unit or auxiliary controllers that could be accessed with a PC via the network. In this case, the RMS controller is the level-1 controller and the chiller controllers are level-2 controllers. Since the RMS Panel is level 1, its hex switch setting must be 00. The hex switch settings of the level-2 controllers must start at 01 and continue consecutively to a maximum of 3F (decimal 63). There must be no gaps in the sequence and no duplicate settings. As long as these rules are followed, a level-2 controller's hex switches can be set to any value. To keep the system simple, you should consider addressing the reciprocating and screw chillers according to thei designations.

For example, assume that a MicroTech network includes an RMS Panel, two reciprocating chillers, and one applied rooftop air handling unit. One possible addressing scheme is as follows:

Hex Switch Setting	Controller
00	RMS Panel
01	Chiller #1
02	Chiller #2
03	Rooftop air handling unit (PC accessible only)

Note: If a PC or modem is connected to a level-2 controller, that controller should have as low an address as possible. This improves the performance of network communications because it reduces the required value of the RMS controller’s Total Slaves parameter and thus the amount of polling. For example, if a modem is connected to Chiller #3, you should consider setting Chiller #3’s hex switches to “01.” See the “RMS and Chiller Controller Setup” section in OM 118 for details.

Networks With an NMP

If an RMS Panel is included in a network that has an NMP, the NMP must be the level-1 controller. In this case, an RMS Panel is a level-2 controller and the chiller controllers are also level-2 controllers. Since the NMP is level 1, its hex switch setting must be 00. The hex switch settings of the level-2 controllers must start at 01 and continue consecutively to a maximum of 3F (decimal 63). There must be no gaps in the sequence and no duplicate settings. As long as these rules are followed, a level-2 controller's hex switches can be set to any value. Two or more RMS Panels and multiple chillers are possible in this type of network.

For example, assume that a MicroTech network includes an NMP, an RMS Panel, two scre chillers, and one applied rooftop air handling unit. One possible addressing scheme is as follows:

Hex Switch Setting	Controller
00	NMP
01	RMS Panel
02	Rooftop air handling unit (PC accessible only)
03	Chiller #1
04	Chiller #2

Networks With Two or More RMS Panels and No NMP

If two or more RMS Panels are included in a network that does not include an NMP, one of the RMS Panels must be the level-1 controller. In this case, the other RMS Panels are level-2 controllers and the chiller controllers are also level-2 controllers. The level-1 RMS Panel's hex switch setting must be 00. The hex switch settings of the level-2 controllers must start at 01 and continue consecutively to a maximum of 3F (decimal 63). There must be no gaps in the sequence and no duplicate settings. As long as these rules are followed, a level-2 controller's hex switches can be set to any value.

For example, assume that a MicroTech network includes two RMS Panels, and four screw chillers. Each RMS Panel controls and monitors two chillers. One possible addressing scheme is as follows:

Hex Switch Setting	Controller
00	RMS Panel "A"
01	RMS Panel "B"
02	Chiller #1 for RMS Panel "A"
03	Chiller #2 for RMS Panel "A"
04	Chiller #1 for RMS Panel "B"
05	Chiller #2 for RMS Panel "B"

Note: The only advantage to creating a network like this is to allow a PC access to all networked controllers. If there is no PC, each RMS Panel should be set up as a level-1 controller in a separate network as described above in "The Typical Network."

Note: If a PC or modem is connected to a level-2 controller, that controller should have as low an address as possible. A level-2 RMS Panel should also have as low an address as possible. This improves the performance of network communications because it reduces the required value of the level-1 RMS controller's Total Slaves parameter and thus the amount of polling. For example, if a modem is connected to Chiller #2 for RMS Panel "B" in the above example, you should conside setting the hex switches for RMS Panel "B" to "01" and the hex switches for its Chiller #2 to "02." See the "RMS and Chiller Controller Setup" section in OM 118 for more information.

Chiller Controller Setup

The chiller controller setup that results by following these instructions is the minimum required fo commissioning the network. Further setup is likely necessary to adapt the chiller controllers to you particular application's requirements. For complete information on how to do this, see the "RMS and Chiller Controller Setup" section in OM 118.

Control Mode

During this commissioning process, it is recommended that the chillers be shut down by setting their control modes to "Manual Unit Off." At the chiller controller's keypad/display, the control mode is the first item under menu 13, "Control Mode." You can get to it quickly by pressing CONTROL.

After communications have been established between the RMS and chiller controllers, the chille control modes can be set as desired (see note below).

Note: Until their controllers are set up properly, the chillers should be manually shut down so that the RMS Panel cannot enable them.

RMS Controller Setup

The RMS controller setup that results by following these instructions is the minimum required fo commissioning the network. Further setup is likely necessary to adapt the RMS controller to you particular application's requirements. For complete information on how to do this, see the "RMS and Chiller Controller Setup" section in OM 118.

Control Mode

Set the RMS Panel's control mode to "All Chillers Off." This prevents chillers from being enabled as they are connected to the network. At the RMS controller's keypad/ display, the control mode is the first item under menu 12, "Control Mode." You can get to it quickly by pressing CONTROL.

After communications have been established between the RMS and chiller controllers, the RMS Panel's control mode can be set as desired.

Number of Chillers

The RMS controller needs to know how many chillers are connected to it. You can set this value at the keypad/ display with the "# Chillers=" item under menu 21, "Misc Setup" (default is 2).

Chiller #1 Address

The RMS controller needs to know the network address of Chiller #1. You can set this value at the keypad/display with the "Chil #1 Addr=" item under menu 21, "Misc Setup" (default is 01). The value of this parameter must match the hex switch setting at Chiller #1.

Chiller #2 Address

The RMS controller needs to know the network address of Chiller #2 (if any). You can set this value at the keypad/ display with the "Chil #2 Addr=" item under menu 21, "Misc Setup" (default is 02). The value of this parameter must match the hex switch setting at Chiller #2. If there is only one chiller in the chiller plant, set this parameter to "NA."

Chiller #3 Address

The RMS controller needs to know the network address of Chiller #3 (if any). You can set this value at the keypad/ display with the "Chil #3 Addr=" item under menu 21, "Misc Setup" (default is N/A). The value of this parameter must match the hex switch setting at Chiller #3. If there are one or two chillers in the chiller plant, set this parameter to "NA."

Controller Level

The RMS controller needs to know whether it is a level-1 or level-2 controller. You can set the controller level at the keypad/display with the "Level=" item under menu 21, "Misc Setup" (default is level 1).

► **To change the controller level**

1. Set the hex switches as required. A level-2 controller's hex switch setting cannot be 00. A level-1 controller's hex switch setting must be 00.
2. At the keypad/display, set the "Level=" item to "1" or "2" as required. When the ENTER key is pressed, the RMS controller automatically corrects its checksums and resets itself. It also changes the Total Slaves parameter to "0" (see below).

Total Slaves

A level-1 RMS controller needs to know how many level-2 controllers (slaves) it needs to poll. (When a level-1 controller polls one of its level-2 slaves, it actively "asks" the slave if it has an requests for information from other controllers.) The Total Slaves parameter defines this number. You can set the Total Slaves parameter at the keypad/display with the "Total Slaves=" item unde menu 21, "Misc Setup" (default is 0). A level-2 RMS Panel's Total Slaves parameter should always be set to "0."

In most cases, the Total Slaves parameter must be changed only if there is (1) a level-2 RMS Panel or (2) a PC connected to a level-2 controller. In the typical chiller plant network, which includes one RMS Panel (level 1) and no PC, the Total Slaves parameter should be set to "0" (default).

If a level-2 controller needs to be polled, set the Total Slaves parameter just high enough to include that controller. For example, assume there are nine level-2 controllers connected to a level-1 RMS Panel; the controller at address 02 is another RMS Panel; and the controller at address 06 has a modem connected to it. In this case, the Total Slaves parameter should be set to "6."

Connecting the Communications Trunk

Use the following two procedures to connect the RMS controller and chiller controllers to the network. You must complete the first procedure before beginning the second. Note that if the RMS and chiller controllers were set up as described above, the chillers are disabled when the RMS controller starts communicating with them.

Communications Cable and Port B Check

The network communications cable should have been installed in accordance with the instructions in the "Field Wiring" section of this manual. This procedure verifies (1) that there are no shorts o stray voltages anywhere in the communications trunk and (2) that port B in each controller is intact. It must be performed once at every controller on the trunk before going on to the following "Verifying Communications" procedure. You can start at any controller and proceed in any order.

Before beginning, verify that the port B connectors are disconnected from every controller on the trunk. On the RMS and chiller controllers, the port B connector is an AMP plug.

1. Verify that there is no voltage between any conductor and ground.

   Use a voltmeter to test for voltage at the network communications field wiring terminal block. With one lead on the control panel chassis (ground), check for voltage at the "+," "–," and "ground" terminals. Table 9 summarizes the terminal labels for the various controllers. There should be no AC or DC voltage.

   If you get a 2 or 3 VDC reading, it indicates that one or more powered controllers are connected to the trunk. These controllers should be located and disconnected.

   Note: The first check should test for voltage throughout the entire trunk; however, it is important that it be done at every controller. Cables look similar and can easily become crossed.

2. Verify that there are no shorts between any two conductors.

   Use an ohmmeter to test for shorts at the network communications field wiring terminal block. For the three combinations of conductor pairs, there should be infinite resistance between the conductors (see Table 9).

   If you find a resistance that is high but less than infinite, it indicates that one or more nonpowered controllers are connected to the trunk. These controllers should be located and disconnected.

   Note: The first check should test for shorts throughout the entire trunk; however, it is important that it be done at every controller. Breaks in the trunk may exist.

3. Plug the network communications connector into the B port.
4. Verify that there is power to the MCB and then check for proper port B voltage levels.

   Use a DC voltmeter to test for proper voltages at the network communications field wiring terminal block. With one lead on the control panel chassis (ground), check the voltage at the "+," "–," and "ground" terminals (see Table 9). The proper voltages are shown in Table 10. Note that the port B terminal labels in Table 10 are for the AMP-type connectors used on the RMS and chiller controllers. Figure 17 shows the terminal configuration for this AMP connector's socket, which is mounted on the MCB board. (The terminals are labeled on both the socket and the plug, but they're hard to see.)

For communications to occur, each networked controller must have proper voltages at its port terminals. When there is only one controller connected to the trunk (as in this check), the measured voltages are for port B on that controller.

If no voltage or improper voltages are found, check the wiring between the port terminals and the field terminals. Using Table 10 and Figure 17, verify that the three conductors are properl terminated in the AMP plug. Remove and check the two fuses above the B port. If there is still a problem, it is likely that the communications driver in the MCB is defective.

5. Unplug the network communications connector from the B port.
6. Go to the next controller and repeat steps 1 through 5.
7. After finishing the last controller, do the following "Verifying C ommunications" procedure.

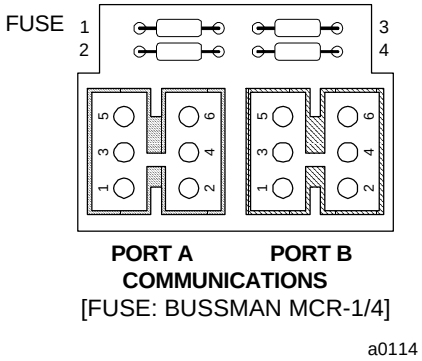
Table 9. Network Communications Field Wiring Terminals

	Network Communications Field Terminal		
Controller	**+**	**–**	**Ground**
RMS Panel	TB2-B+	TB2-B–	TB2-GND
Reciprocating Chiller	TB7-138	TB7-137	TB7-139
Screw Chiller	TB4-54	TB4-53	TB4-55

Table 10. Port B Voltages (AMP Type)

Port B (RS-485)		
Signal	**Terminal**	**Acceptable Voltage Reading**
+	4	3.0 ± 0.3 VDC
–	3	2.0 ± 0.3 VDC
Ground	5	0.0 ± 0.2 VDC

Figure 17. AMP Connector Terminal Configuration



Verifying Communications

This procedure verifies that proper communications have begun for each controller as it is connected to the network. The procedure begins with the level-1 controller because it coordinates network communications. After connecting it, you should connect any level-2 RMS Panels and then the level-2 chiller controllers. You can connect the chiller controllers in any order; however, it is better to follow the daisy-chain as you proceed. This makes troubleshooting easier if communications problems occur. For the typical network in which there is no Network Maste Panel, the RMS Panel is the level-1 controller and the chillers are level-2 controllers.

As a result of the previous procedure, the network communications connector should be disconnected from the B port at every controller on the trunk. Be sure that this is true before beginning this procedure.

1. Verify that the level-1 controller has a hex switch setting of 00. See "Addressing the Controllers" above for more information.
2. Plug the level-1 controller's network communications AMP connector into the B port. Verif that there is power to the level-1 controller and then go to the first level-2 controller.
3. Verify that the controller has the correct level-2 network address. See "Addressing the Controllers" above for more information.
4. With the controller's B port disconnected, check for proper communications trunk voltage levels.

   Use a DC voltmeter to test for proper voltages at the network communications field wiring terminal block. With one lead on the control panel chassis (ground), check the voltage at the "+," "–," and "ground" terminals (see Table 9). The proper voltages are shown in Table 10.

   If no voltage or improper voltage levels are found, verify that the level-1 RMS Panel or NMP is energized and that the communications trunk wiring is intact.
5. Verify that there is power to the MCB and then plug the network communications connecto into the B port.
6. Verify that network communications have begun.

   Go to the RMS Panel's keypad/display and select the chiller just connected. (If the controlle you just connected is a level-2 RMS Panel, go to step 7.) To do this, press the SWITCH key and then quickly press the NEXT key in the Menu key group. Repeat this keystroke combination as necessary to get the desired chiller. The Unit Selection LED for the selected chiller illuminates. The keypad/display should show the chiller controller's data.

   If communications do not exist, the message "Communications lost w/chiller" appears in the display. In this case, check the terminations between the B port and the field terminal block at the chiller and, if no other chillers are communicating, its RMS Panel. If the chiller controlle just connected is associated with a level-2 RMS Panel, make sure that this RMS Panel's level was changed from 1 to 2.

   Note: If the level-2 controller is not an RMS or chiller controller, you need a PC to verif communications. Refer to the user's manual provided with the Monitor software for more information.
7. Go to the next controller and repeat steps 3 through 6.
8. After finishing the last level-2 controller, each RMS Panel's Comm O.K. LED should be lit and not blinking, proving that network communications exist throughout the chiller plant. If the chillers have been commissioned, set up the RMS and chiller controllers as desired for normal operation.

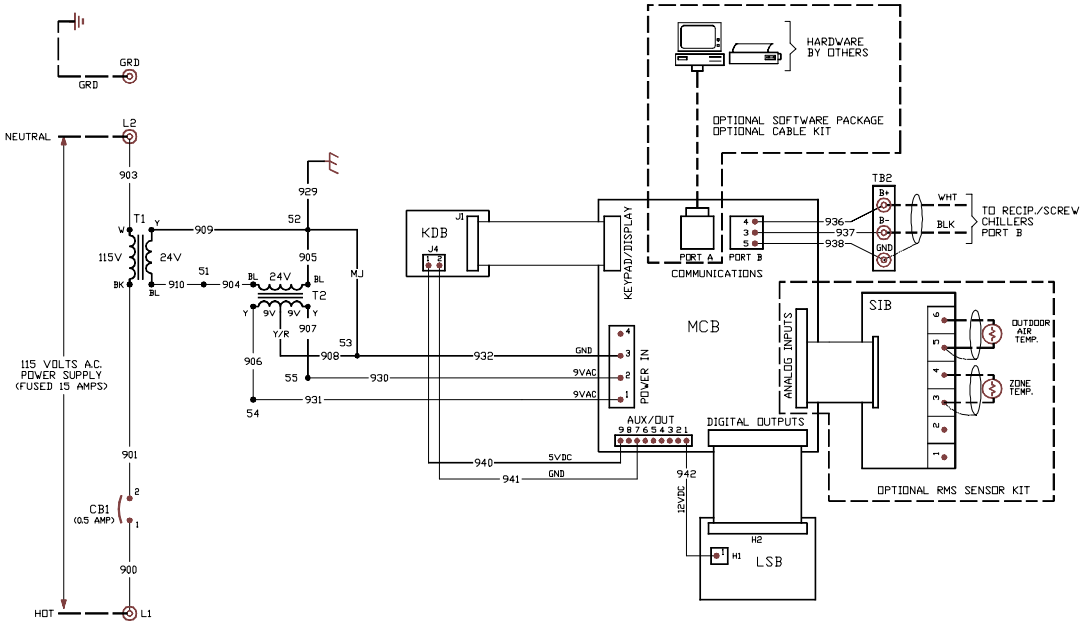
Wiring Diagram

The following wiring diagram is identical to the one in the RMS Panel. It is reproduced here fo your convenience. The legend is shown in Figure 18.

Figure 18. RMS Panel Schematic Legend

Component Designation	Description
CB1	Circuit Breaker
KDB	Keypad/Display Board
LSB	LED Status Board
MCB	Microprocessor Control Board
SIB	Sensor Input Board
T1	Transformer: 115/24 VAC
T2	Transformer: 24 VAC/18 VAC-CT
TB1	Terminal Block: High Voltage Section
TB2	Terminal Block: Low Voltage Section
—911—	Factory Wire Number
	Field Wiring Terminal
	Field Wiring
	Printed Circuit Board Terminal
	Twisted, Shielded Pair Cable

Figure 19. RMS Panel Schematic



Test Procedures

A listing of MicroTech related part numbers is included in the "Parts List" section of this manual. If the MCB must be replaced, refer to the "MCB Replacement" section of this manual.

Status LED Diagnostics

The MCB status LED indications can aid in controller diagnostics. If the status LEDs do not operate normally as described in the "Component Data" section of this manual (see Table 3), there is a problem with the MCB. Following are troubleshooting procedures for the various symptoms.

Red LED Remains On

If the red LED remains on after the 5-second self-test period, it is likely that the MCB is defective. However, this can also occur in some instances if there is a power supply problem. Refer to "Troubleshooting Power Problems" below.

Red and Green LEDs Off

If the red and green LEDs do not turn on after power is applied to the controller, there is likely a defective component or a problem in the controller's power distribution circuits. Refer to "Troubleshooting Power Problems" below.

Troubleshooting Power Problems

The MCB receives 18 Vac, center-tapped power from transformer T2. It then distributes both 5 Vdc and 12 Vdc power to the various MicroTech components. A problem that exists in any of these components can affect the MCB and thus the entire control system. Power problems can be caused by a external short, which can blow a fuse, or a defective component, which can either blow a fuse or create an excessive load on the power supply. An excessive load can lower the power suppl voltages to unacceptable levels. Use the following procedure to isolate the problem. Note that this procedure may require two or three spare MCB fuses (see parts list). Refer to the panel wiring diagram or Figure 19 as you proceed.

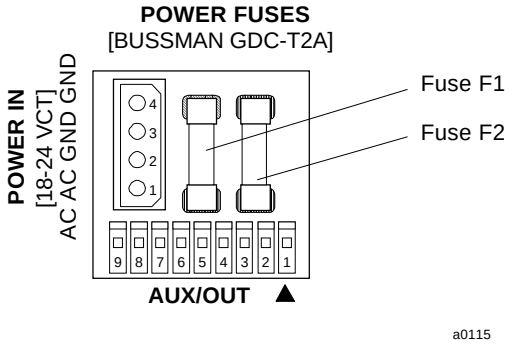
1. Verify that circuit breaker CB1 is closed.
2. Remove the MCB Power In terminal strip connector and check for 9 Vac between the terminals on the plug corresponding to terminals 2 and 3 on the board (see Figures 6 and 20). Then check for 9 Vac between the terminals on the plug corresponding to terminals 1 and 3 on the board. (Readings of 9–12 VAC are acceptable.)
   a. If 9 Vac is present between both sets of terminals, go to step 3.
   b. If 9 Vac is not present between both sets of terminals, check transformers T2 and T1 and all wiring between the 115 Vac source and the Power In plug.
3. Remove power from the controller by opening circuit breaker CB1. Check the MCB powe supply input fuses (F1 and F2) with an ohmmeter. See Figure 20. A good fuse will have negligible resistance through it (less than 2 ohms).

   If either or both fuses are blown, replace them. Go to step 4.

   If the fuses are intact, the MCB is defective.
4. Reconnect the Power In plug and disconnect all other connectors on the MCB. Cycle po er to the controller (close and then open CB1) and check the power fuses.
   a. If both fuses are intact, go to step 5.
   b. If either fuse blows, the MCB is defective.
5. Reconnect the keypad/display ribbon cable. Cycle power to the controller and check the powe fuses.
   a. If both fuses are intact, go to step 6.
   b. If either fuse blows, check the keypad/display and the connecting ribbon cable for shorts. Either one may be defective.

6. Reconnect the analog input ribbon cable (if any). Cycle power to the controller and check the power fuses.
   a. If both fuses are intact, go to step 7.
   b. If either fuse blows, check the SIB board, the connecting ribbon cable, the thermistors, and the field wiring for shorts. Any of these may be defective.
7. Reconnect the Aux/Out connector plug to the MCB. Disconnect the 12 Vdc power plug from the LSB. Cycle power to the controller and check the power fuses.
   a. If both fuses are intact, go to step 8.
   b. If either fuse blows, it is likely that the keypad/ display is defective.
8. Reconnect the digital output ribbon cable to the MCB. Reconnect the 12 VDC power plug to the LSB. Cycle power to the controller and check the power fuses.
   a. If both fuses are intact, the problem is indeterminate. Obtain factory service.
   b. If either fuse blows, check the LSB board and the connecting ribbon cable for shorts. Eithe one may be defective.

Figure 19. MCB Power Supply Terminals



Troubleshooting Communications Problems

If the Comm O.K. LED on the LSB board is flashing, it indicates that a network communications problem exists. An alarm message on the keypad/display indicates which chiller(s) the RMS Panel has lost communications with. Troubleshooting this type of problem is limited to the following:

- Checking the port B voltages
- Checking the port B fuses
- Checking the network wiring integrit
- Checking the network addressing

The best way to accomplish these checks is to perform the start-up procedures in the “Network Commissioning” section of this manual. If these procedures have been performed and the problem persists, obtain factory service.

Troubleshooting Analog Input Problems

The controller receives its analog inputs from the optional Signal Input Board. Following are procedures that can be used to isolate analog input problems. Refer to the panel wiring diagram o Figure 19 as you proceed.

Table 11. Thermistor Chart

°F	Ohms	Volts
15	16,104	4.145
16	15,627	4.124
17	15,166	4.102
18	14,720	4.080
19	14,288	4.057
20	13,871	4.034
21	13,467	4.011
22	13,076	3.988
23	12,698	3.964
24	12,333	3.940
25	11,979	3.915
26	11,636	3.890
27	11,304	3.865
28	10,983	3.839
29	10,672	3.814
30	10,371	3.788
31	10,079	3.761
32	9797	3.734
33	9523	3.707
34	9258	3.608
35	9002	3.653
36	8753	3.625
37	8512	3.597
38	8278	3.569
39	8052	3.540
40	7832	3.511
41	7619	3.482
42	7413	3.453
43	7213	3.424
44	7019	3.394
45	6831	3.365
46	6648	3.335
47	6471	3.305
48	6299	3.274
49	6133	3.244
50	5971	3.213
51	5814	3.183
52	5662	3.152
53	5514	3.121
54	5371	3.078
55	5231	3.059
56	5096	3.028
57	4965	2.996
58	4838	2.965
59	4714	2.934
60	4594	2.902
61	4477	2.871
62	4363	2.839
63	4253	2.808
64	4146	2.777
65	4042	2.745
66	3941	2.714
67	3842	2.682
68	3748	2.651
69	3655	2.620
70	3565	2.589
71	3477	2.558
72	3392	2.527
73	3309	2.496
74	3228	2.465
75	3150	2.434
76	3074	2.404
77	3000	2.373
78	2927	2.343
79	2857	2.313
80	2789	2.283
81	2723	2.253
82	2658	2.223
83	2595	2.194
84	2534	2.164
85	2474	2.135
86	2416	2.106
87	2360	2.077
88	2305	2.049
89	2251	2.020
90	2199	1.992
91	2149	1.965
92	2099	1.937
93	2051	1.909
94	2004	1.882
95	1959	1.855
96	1914	1.828
97	1871	1.802
98	1829	1.775
99	1788	1.750
100	1747	1.724
101	1708	1.698
102	1670	1.673
103	1633	1.648
104	1597	1.624
105	1562	1.600
106	1528	1.576
107	1494	1.552
108	1461	1.528
109	1430	1.505
110	1398	1.482
111	1368	1.459
112	1339	1.437
113	1310	1.415
114	1282	1.393
115	1254	1.371
116	1228	1.350
117	1201	1.328
118	1176	1.308
119	1151	1.287
120	1127	1.267
121	1103	1.247
122	1080	1.227
123	1058	1.208
124	1036	1.189
125	1014	1.170
126	993	1.151
127	973	1.133
128	953	1.115
129	933	1.097
130	914	1.079
131	895	1.062
132	877	1.045
133	859	1.028
134	842	1.012
135	825	0.995
136	809	0.980
137	792	0.963
138	777	0.948
139	761	0.932
140	746	0.917
141	731	0.902
142	717	0.888
143	703	0.874
144	689	0.859
145	676	0.846
146	662	0.831
147	649	0.818
148	637	0.805
149	625	0.792
150	613	0.779
151	601	0.766
152	589	0.753
153	578	0.741
154	567	0.729
155	556	0.717
156	546	0.706
157	535	0.694
158	525	0.683
159	516	0.673
160	506	0.661
161	496	0.650
162	487	0.640
163	478	0.629
164	469	0.619
165	461	0.610
166	452	0.599
167	444	0.590
168	436	0.580
169	428	0.571
170	420	0.561
171	413	0.553
172	405	0.544
173	398	0.535
174	391	0.527
175	384	0.518
176	377	0.510
177	370	0.501
178	364	0.494
179	357	0.485
180	351	0.478
181	345	0.471
182	339	0.463
183	333	0.456
184	327	0.448
185	321	0.441
186	316	0.435
187	310	0.427
188	305	0.421
189	299	0.413
190	294	0.407
191	289	0.400
192	284	0.394
193	280	0.389
194	275	0.382
195	270	0.376
196	266	0.371
197	261	0.364
198	257	0.359
199	252	0.353
200	248	0.348

Open or Shorted Temperature Sensor Circuits

The controller can assist in the diagnosis of temperature sensor problems by displaying eithe “open” or “short” instead of a temperature value on menu 7 of the keypad/ display

If menu 7 indicates a problem, check the sensor circuit wiring for shorts or disconnections. If the sensor circuit wiring and connections are intact, the sensor is probably defective. Verify this b performing the following "Erroneous Temperature Readings" procedure.

Erroneous Temperature Readings

If it is suspected that the controller is operating using erroneous temperature data, the following procedure can be used to check for problems:

1. Remove power from the controller by opening circuit breaker CB1. Verify that the MCB-to-SI and MCB-to-KDB ribbon cable connections are proper. Look for bent pins. After reconnecting the ribbon cables, restore power to the controller.
2. Measure the temperature at the suspect sensor using an accurate thermometer.
3. Determine the sensor's associated SIB terminals. Refer to the panel wiring diagram.
4. Remove power from the controller. Disconnect the suspect sensor's cable from the SIB field wiring terminal block and measure the resistance across the conductors. Using the thermisto chart (Table 11), compare this value with the measured temperature.
   a. If the measured resistance and temperature match, go to step 5.
   b. If the measured resistance and temperature do not match, either there is a wiring problem or the sensor is defective. Check the sensor circuit wiring and connections for defects.
5. Reconnect the sensor cable to the SIB. Restore power to the controller and measure the DC voltage across the sensor terminals on the SIB. Using the thermistor chart, compare this value with the measured temperature.
   a. If the measured voltage and temperature do not match, go to step 6.
   b. If the measured voltage and temperature match, the MCB is probably defective.
6. Measure the DC voltage between terminal 2 on the SIB and chassis ground. It should be 5 VDC.
   a. If the voltage is 5 Vdc, the SIB board is probably defective.
   b. If the voltage is not 5 Vdc, the MCB or the MCB-to-SIB ribbon cable is probably defective.

Troubleshooting the LED Status Board

The LED Status Board is connected to the MCB via a 26-conductor ribbon cable and discrete wiring for the 12 Vdc power. The MCB provides power and control signal outputs for the LEDs.

Board Component Defective

If one of the LEDs, the alarm horn, or the alarm volume pot is bad, the LSB board must be replaced.

All LEDs Out

If there is power to the panel, two LEDs should always be lit: the Comm O.K. LED and one of the Unit Selection LEDs. If the green status LED on the MCB is lit, but no LEDs on the LSB are lit, perform the following procedure:

1. Check the ribbon cable and connections between the LSB and the MCB. Look for bent pins.
2. Check for 12 Vdc at terminal 1 on the H1 plug on the LSB. Refer to the panel wiring diagram or Figure 19. To take the voltage reading, pull the plug back about one-eighth of an inch and place the test lead against the exposed pin. Place the other lead on chassis ground.
   a. If there is no voltage, go to step 3.
   b. If there is 12 VDC, the LSB is probably defective.
3. Check the wiring and connections between the Aux/Out terminal strip and the LSB. If the wiring is intact, the MCB is probably defective.

Troubleshooting the Keypad/Display Board

The Keypad/Display Board is connected to the MCB via a 26-conductor ribbon cable and discrete wiring for the back light. The MCB provides operating voltages, control signal outputs for the display, and input conditioning for the keypad inputs.

Display is Hard to Read

The clarity of the LCD display can be affected by ambient temperature. Typically, less contrast results with cooler temperatures. If the display is difficult to read, adjust the contrast trim pot, which is located on the back of the keypad/display assembly (see Figure 5).

Back Light Not Lit

The Keypad/Display Board supplied with the RMS Panel is equipped with a back light. If the light does not come on, check for 5 Vdc at terminal 1 on the J4 plug on the KDB. Refer to the panel wiring diagram or Figure 19. Note that this terminal is the one closest to the ribbon cable connector. To take the voltage reading, pull the plug back about one-eighth of an inch and place the test leads against the exposed pins. If there is no voltage, check the wiring and connections between the Aux/Out terminal strip and the KDB. If the wiring is intact, the MCB is probably defective.

Display is Blank or Garbled

If the MCB appears to be functioning properly and the display is completely blank or garbled, perform the following procedure:

1. Try cycling power to the controller by opening and then closing circuit breaker CB1 (see note below).
2. Try adjusting the contrast trim pot, which is located on the back of the keypad/display assembl (see Figure 5). If the contrast trim pot has no effect, it is likely that either the keypad/display o its ribbon cable is defective.
3. After removing power from the controller, check the ribbon cable and connections between the keypad/ display and the MCB. Look for bent pins. Restore power after reconnecting the ribbon cable.
4. Try swapping a known good ribbon cable and keypad/ display. (These may come, for example, from a chiller controller. The keypad/display does not need a back light.) Swap these components separately to isolate the problem. Remove power from the controller before disconnecting the suspect component, and restore power after connecting the replacement component. If the problem persists, it is likely that the MCB is defective.

Note: The keypad/display and MCB must be powered up together; otherwise, the display is blank. Therefore, if the keypad/display is ever disconnected from the MCB and then reconnected, power to the controller must be cycled to restore the display. You can cycle power to the controller b opening and then closing circuit breaker CB1.

MCB Replacement

If an MCB board is defective and must be replaced, the proper controller software must be loaded into the replacement MCB. This can be done either at the factory or at the building site—if a PC equipped with appropriate Monitor software is available.

The factory will download the proper controller software into a replacement MCB board before it is shipped if you include the RMS controller's program code with the replacement MCB part order. If the program code is not provided, the MCB board is shipped without software.

Job-specific Monitor software includes each unit and auxiliary controller's program. Therefore, it is possible to download the proper controller software to a replacement MCB at the building site if a PC equipped with that job's Monitor software is available. In addition, if the controller's configuration data was stored on the PC hard drive prior to the MCB failure, the exact configuration data (including all keypad programmable setpoints and parameters) can be restored. Refer to the user's manual supplied with the Monitor software for more information.

Parts List

Component Designation	Description	Part No.
MCB	Microprocessor Control Board ① ②	654873B-06
KDB	Keypad/Display Board	654972B-02
LSB	LED Status Board	664011A-01
SIB	Sensor Input Board	571870A-01
T1	Transformer: 115/24 VAC	606308B-01
T2	Transformer: 24/18 VAC, Center Tapped	467381B-14
CB1	Circuit Breaker	350A733H01?
–	Ribbon Cable Assembly: 26-Conductor, MCB to LSB	664012B-01
–	Ribbon Cable Assembly: 26-Conductor, MCB to KDB	654997B-05
–	Fuse: MCB Input Power, 2 Amp (Bussman No. GDC-2A)	658220A-01
–	Fuse: MCB Communication Ports, 0.25 Amp	658219A-01
–	RMS Sensor Kit	0057186701
–	PC Communications Cable Kit	0057186802
–	RS-232 Cable Extension Kit	0065487001
–	Modem Kit	0072140601

Notes:

1. If desired, the factory can download the correct software into the replacement MCB prior to shipment. See the "MCB Replacement" section above for more information.
2. MCB part number 654873B-06 includes a high memory chip. In addition to itself, this part replaces MCB boards with part numbers 654873B-01 and 654873B-03.

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